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More screen operation than calling: The results of observing cyclists' behaviour while using mobile phones

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Abstract

Operating a mobile telephone while riding a bicycle is fairly common practice in the Netherlands, yet it is unknown if this use is stable or increasing. As such, whether the prevalence of mobile phone use while cycling has changed over the past five years was studied via on-road observation. In addition the impact of mobile phone use on lateral position, i.e. distance from the front wheel to the curb, was also examined to see if it compared to the results seen in previous experimental studies.

Bicyclists were observed at six different locations and their behaviour was scored. It was found that compared with five years ago the use of mobile phones while cycling had changed, not in frequency, but in how cyclists were operating their phones. As found in 2008, three percent of the bicyclists were observed to be operating a phone, but a shift from calling (0.7% of cyclists observed) to operating (typing, texting, 2.3% of cyclists) was found. In 2008 nearly the complete opposite usage was observed: 2.2% of the cyclists were calling and 0.6% was texting. Another finding was that effects on lateral position were similar to those seen in experimental studies in that cyclists using a phone maintained a cycling position which was further away from the curb. It was also found that when at an intersection, cyclist’s operating their phone made less head movements to the right than cyclists who were just cycling. This shift from calling to screen operation, when combined with the finding related to reduced head movements at intersections, is worrying and potentially dangerous.

Highlights:

- Incidence of mobile phone use while cycling has not changed since 2008

- Use of Mobile phones has changed, there is now less calling and more screen operation

- Phone use coincides with increased distance from the curb

- The effects found are similar independent of the type of bicycle infrastructure

- Head movements at intersections are slightly reduced by phone use

Keywords:

Bicycling, Smartphone, Mobile phone, Lateral position, Head movements

1. Introduction

There is extensive research on the effects of using mobile phones while driving a car and in general this research shows a deterioration in vehicle control (e.g., Caird, Willness, Steel, & Scialfa, 2008). As such, in most countries legislation has been introduced so that only hands free use of mobile phones is allowed, if mobile phone use is allowed at all (e.g., Ibrahim, Anderson, Burris, & Wagenaar, 2011, Waddell, & Wiener, 2014). In addition to the effects on car drivers, prevalence of operating a mobile phone while riding a motorcycle have also been recently researched; Pérez-Núñez, et al. (2014) observed that 0.64% operated a phone while riding a motorcycle. Again in most countries, including Mexico, operation of mobile phones while riding is illegal (Pérez-Núñez, et al., 2014). When it comes to riding a bicycle the situation is different, and differs between countries. In Japan, for example, it is not permissible to operate a phone while bicycling (Ichikawa & Nakahara, 2008), while in Germany and Belgium mobile phone use while cycling is only allowed with a hands free set (see Mwakalonge, White, & Siuhi, 2014). In the Netherlands, even though such use when driving a car is forbidden, it is not illegal to operate a phone while cycling, although the general rule that traffic safety may not be endangered still applies. Indeed, phone use while cycling is relatively common in the Netherlands. For example, in 2008 in the city of Groningen 2.2 % of cyclists observed during an on-road study were seen to be talking on their mobile phone, while 0.6% appeared to be operating the keyboard in a fashion that could suggest texting behaviour (De Waard et al., 2010). Similarly, in 2012 Terzano (2013) observed 1360 bicyclists in the city of The Hague and found that 3.5% were operating a mobile phone. This slightly higher (+0.7%) percentage of mobile phone users in The Hague compared with Groningen may reflect an increase in phone user over the four years' time difference, or may reflect differences in the habits of cyclists between the two cities. Furthermore, in an internet survey of Dutch cyclists, Goldenbeld, Houtenbos, Ehlers, and De Waard (2012) found that 17% of the cyclists reported using their phone on every trip they make, while 55% said that they occasionally made phone calls while cycling. Information on the use of mobile phones while riding a bicycle in countries other than the Netherlands is unfortunately scarce, but Yang et al. (2012) reported that the use of a mobile phone while riding an electrical bicycle was only 0.43% of the cyclists observed in Suzhou, China. Also, in a survey completed in the USA 9% of the 2580 respondents indicated that they made use of electronic equipment during every ride they made (Schroeder & Wilbur, 2013). Unfortunately no division in type of electronic device operated was made, an electronic device could thus be a mobile phone, an mp3 music player, or some kind of GPS or electronic exercise tracker.

In terms of examining the impact of mobile phone use while cycling accident statistics could be examined. However, statistics on bicycle accidents in which mobile phone use has played a role are likely to be biased, as admitting phone use while cycling may be avoided even when there is no formal penalty for it. In a survey completed by 1142 cyclists treated at the emergency care department of a selection of hospitals in the Netherlands (De Waard et al., 2010) only 0.3% stated they had been talking on their mobile telephone at the time of the accident, while 0.2% said they had been texting. Furthermore, in the 10 minutes preceding the accidents 2.5% of the cyclists reported that they had been operating their mobile phone. These post-accident reports are different from the results of the aforementioned internet survey (Goldenbeld et al., 2012) where respondents reported that during 10% of the reported non-injury accidents and 9% of the reported injury accidents that they were using a portable electronic device. However, these latter results again include listening to music with a portable device. Also, both studies are questionnaire studies, which have response bias limitations and may suffer from social desirability biases. As such, the actual prevalence of mobile phone use associated with accidents is more likely to be higher than lower.

As an alternative to looking at accident data, a series of experimental studies have been carried out to examine the impact of mobile phone use on bicyclist's behaviour (De Waard et al., 2010, 2011, 2014). These experiments found effects of phone use on lane control, lane position, speed, and object detection performance in peripheral field tests. Specifically, in terms of lane position, when operating a mobile phone, in particular when texting, and even more so when using a touch screen telephone (De Waard et al., 2014), users increased the distance they kept from the curb compared to conditions in which they did not use a phone. This could be risky in situations where cyclists shift position in the direction of other larger vehicles that they may be sharing the road with. Although the studies were performed outdoors on participant's own bicycles, these are results that were obtained in experimental studies that were completed under controlled conditions on a remote, isolated quiet bicycle path. As such, an unanswered question is whether the effects on lane position found in the experiments could also be found in real, busy, and sometimes mixed traffic, as behavioural response may vary depending on the road environment. In the Netherlands there are separate bicycle paths with one or two way bicycle traffic, there are bicycle lanes that are part of the main road only separated by a white line and indicated by red coloured asphalt, and there are locations where cyclists share the main road without an indicated lane. All of these different road environments may produce different behaviours in cyclists and other road users.

In addition to lane position, the looking behaviour of cyclists also seems to be affected by secondary tasks. In her observation study in The Hague, Terzano (2013) rated the behaviour of cyclists who were using mobile phones more frequently as "unsafe" than the behaviour of bicyclists who were not performing a secondary task. The classification of behaviour as safe/unsafe however, was subjective, even though a few examples of unsafe behaviour were given. The author also states "We do not know whether those bicyclists who were performing a secondary task were distracted by that task or, if distracted, to what degree they were distracted" (Terzano, 2013, p. 89). Nevertheless, the study does give an indication of the frequency of phone use and perceived effects on safety. With regard to looking behaviour, in the experimental studies performed on the isolated bicycle path (De Waard et al., 2010, 2011, 2014) objects positioned in the periphery were more frequently missed when cyclists operated a mobile phone. However, that task was an artificial secondary task and may not be a good indication of looking behaviour and detection performance in real life.

In the present study the use of mobile phones was again observed via an on-road study to see if usage in the same city, Groningen, has changed since 2008 (De Waard et al., 2010). As touch screen devices with multiple functions have become more common since 2008, another aim was to observe how people operate their phone in daily cycling and if this had changed since 2008. Lateral position was also examined to see whether the results found in the previously reported experimental studies were also seen under real world conditions, namely that cyclists would increase their distance from the curb when operating a phone. In addition behaviour on different cycle paths/environments was compared, as these environments may have an influence on position on the road, and on the use of mobile phones.

2. Method

2.1 Measures and locations

Approval for this study was obtained from the Ethical Committee Psychology of the University of Groningen. Video observations were made at six locations in the city centre of Groningen between April 23rd and July 2nd, 2013. The first aim was to assess whether the use of a mobile phone while cycling had changed as comparted with data collected in 2008 (De Waard et al., 2010). As such, whether or not bicyclists operated a phone was scored at all six locations.

The characteristics of the roads and bicycle paths differed between the six locations and are listed in tables 1 and 2, and can be seen in figure 1. Three comparisons were made between these six locations:

(1) Behaviour while riding in a bicycle lane, i.e. a lane indicated on the road shared with motorised traffic versus while sharing the road with motorised traffic without an indicated lane (Road 1),

(2) Behaviour on one versus two-way traffic bicycle paths that are physically separated from the main road, and

(3) Behaviour on a road shared with traffic (Road 2) versus on an intersection.

=== Insert Tables 1 and 2 about here ===

It was not possible to score the same behaviour at all locations, for example on the intersection there is no curb so lateral position was not assessed (see table 1). However, at this location gaze as indicated by head movements were scored.

A camcorder (JVC Everio, video resolution 720 x 576 pixels) was attached to a lamppost next to the road at two metres height and positioned opposite the bicyclists' cycling direction. All passing cyclists were scored on whether they operated a mobile phone or not. If a bicyclist was using a mobile phone, they were classified as calling (holding the phone against their ear) or operating the screen (composing a text message, reading from the screen, or searching a song or an address on their telephone) and then the parameters listed in table 1 were scored. Note that "screen operation" is used as collective reference term for texting and operating the phone and reflects that the eyes of the bicyclist were off the road and directed towards the screen of the telephone, for example the operation of conventional telephones with a keypad was also scored as 'screen operation'. The next passing cyclist who was not operating a telephone was scored as control. Should two phone users pass the camera in succession then the two bicyclists following the first phone using cyclist were scored. Care was taken that the 'control cyclist' was only assessed if the 'mobile phone cyclist' was out of sight, so no influence of the lead mobile phone using cyclist should have taken place. Comparisons and analyses (performed with SPSS for Windows, IBM statistics version 20) were completed per location (rows in table 1). Three observers scored video data, each took care of the data regarding a main comparison listed in Table 1.

======= Insert Figure 1 and 2 about here ===

2.2 Lateral position

The video data were analysed using the "Kinovea for Windows" application. All the recorded video was reviewed and passing cyclists using a mobile phone were marked. Subsequently, the distance from the curb was measured by using a digital ruler (JRulerPro version 3.1, see figure 2). The ruler was calibrated, using custom PPI settings, in perspective to reflect real world distances and intervals of 10 centimetres were marked. The distance between the front wheel and the curb was measured.

2.3 Head movements

Due to the study design it was not possible to record eye movements. As such, looking behaviour was operationalized by scoring the number of head movements in two directions, to the left and to the right. Head movements were scored in a fixed area of travel of 13 metres of roadway, on two locations. The first location was an intersection and the second location was on a straight road (that actually preceded the intersection). At the intersection bicyclists had to give right of way to traffic from both the left and the right.

3. Results

3.1 Participants

As listed in table 1, a total of 37 hours of video was recorded. All recordings were performed during daytime and dry weather conditions. During the study a total number of 7102 cyclists were filmed (table 3). Three percent (N=211) were observed using a mobile phone while bicycling. As summarized in table 3, the percentage of phone using cyclists did not differ substantially from 2008 (De Waard et al, 2010), but in the current study the majority were observed to be operating the screen of the telephone (‘texting’) (77%) while in 2008 the majority of phone using cyclists were ‘calling’ (79%).

=== Insert Table 3 about here ===

3.2 Lateral position

For assessment of lateral position a total of 222 telephone-operating and control cyclists were selected from locations [1] and [2] listed in Table 1. There was no difference in proportion males between the telephone-operating and control group of bicyclists (43.6% male, χ^2, df=1)=0.28, NS). Thirty were cycling on the two way bicycle path, 39 on the one way bicycle path, 68 in the bicycle lane, and 85 on the street locations (see table 4). Bicyclists cycling together were excluded from the analyses, and on the two-way bicycle path only cyclists cycling in the same direction as on the one way path were selected, as only then in both conditions a curb to the right was present. The distribution of distance from the curb was skewed and therefore a non-parametric Kruskal-Wallis test was performed to determine the effects of phone usage and location on distance from the curb.

As displayed in figure 3, there is a significant main effect of phone use on lateral position (H(χ^2, df=2)= 25.19, p<.001). The results of additional three exploring Mann-Whitney U Tests are presented in table 6. A Bonferroni-corrected α-value of 0.0167 was applied to correct for three multiple comparisons. The results show that screen operating cyclists maintain a significantly greater distance from the curb compared to calling and non-phone using cyclists. Furthermore, no differences were found between the non-phone using group and the calling group.

Age could only be roughly categorised based on an estimate and was classified in four categories: < 15 years, 15-35, 35-60, and 60+ years of age. The majority of scored bicyclists was between 15-60 years of age. Phone users were younger: 89% of the non-phone users, 99% of the screen operating cyclists, and 100% of the calling cyclists, differences in age distribution between the control and the phone operating cyclist groups are significant (χ^2, df=3= 31.4, p<.001). There were hardly any cyclists included who were below 15 years (N=2), or above 60 years of age (N=13).

=== Insert Tables 4 and 5 about here ===

When a cyclist was on the street or in the bicycle lane, then the road was shared with motor vehicles, mainly cars and buses (see figure 1, top photos). As listed in table 5, in 11.8% of the cases a motor vehicle was present for observed cyclists in the bicycle lane and on the street location this percentage was 4.7%. To test whether these vehicles had an influence on the distance of the cyclist from the curb, the same analysis outlined above was run after removing the cases where a passing motor vehicle had been present. After this correction, the significant main effect of phone use on lateral position remains (H(χ^2, df=2)= 22.91, p<.001). The significant differences between the screen operating and non-phone using groups also remain intact (Z=-4.168, p<.001, r=-0.031), and once again screen operating cyclists maintain a larger distance from the curb compared to calling cyclists (Z=-3.402, p=.001, r=-0.33, see also table 6).

=== Insert Table 6 about here ===

Further exploring the data per group and location, it was found that there is a significant effect of location on distance from the curb (H(χ^2, df=3) = 14.47, p=.002). Because of the skewed distribution of distance from the curb it is not possible to test for the interaction phone use x location. However, figure 4 suggests that it is unlikely that there is an interaction effect.

=== Insert Figures 3 and 4 about here ===

3.3 Head movements

The sampled participant data from both the intersection and road locations (location [3] in table 3) is summarized in table 7. The distributions of the frequency of head movements were skewed, thus non-parametric tests were performed to assess the effects of phone use on looking behaviour at the two locations. As listed in table 8, and shown in figure 5, there is an effect of location on all the scored variables. Therefore, both locations are explored and analysed separately in the following paragraphs.

=== Insert Tables 7 and 8 about here ===

As the default head direction of cyclists was forward, only head movements to the left and right were scored. As depicted in figure 5, on the road only a small amount of phone using cyclists turned their head to the left, and no one turned their head to the right. Within the non-phone users group, a very small number of cyclists were observed turning their head to the right. Phone use had a marginally significant effect on left head movement frequency (Kruskal-Wallis test, H (χ^2, df=2) =6.426, p=0.040) and only the difference between non-phone users and screen operators was statistically significant (Mann-Whitney U Z=-2.20, p=0.028).

=== Insert Figure 5 about here ===

More relevant are head movements on the intersection where a larger amount of total head movements were observed when compared to the road location (see figure 5). On the intersection the cyclists were observed to move their heads more often in both the left and right hand directions. Cyclists generally need to do this to be able to pass the intersection safely (they need to give way), as opposed to the road location where looking in these directions was not as necessary for safe cycling. Furthermore, as shown in table 9 cyclists using a mobile phone performed a significantly smaller number of head movements in the right-hand direction while passing the intersection compared to cyclists not using a mobile phone (table 10). The effect sizes are, however, small to moderate in the screen operating group and very small for the calling group, compared to the non-phone using cyclists.

=== Insert Tables 9 and 10 about here ===

4. Discussion & conclusion

The present observation study delivered two important outcomes. First, over a period of five years the percentage of cyclists that operate a mobile phone while cycling has not changed, but the way that cyclists are using their phones has changed. Specifically, they are more often looking down at their screens and operating their phones rather than calling. Secondly, it was observed that in line to earlier experimental findings (De Waard et al., 2014) bicyclists kept more distance from the curb when operating a telephone under these real world conditions. These results indicate that bicyclists operating a mobile phone may increase their safety margins (Summala, 2005) in terms of keeping more distance from the curb, which is a more immediate and constant threat. However, this movement away from the curb may place them at more risk of colliding with other road traffic.

An influence of road infrastructure on lane position was not found, which is remarkable. One may expect on a road shared with motorised vehicles and large buses that cyclists operating their mobile phone would keep distance from these vehicles and move towards the curb, resulting in riding closer to the curb than on cycle paths that are physically separated from the road. In the observation studies this was not found, rather distance from the curb increased in all conditions if cyclists were operating the screen. It could be that cyclists do not experience a shared road as more dangerous, or perhaps feel that cars and buses will pass at greater distance whereas the curb is a constant, immobile, threat. As single bicycle accidents are still the most common type of bicycle accident (Larsson, 2008, Schepers, 2012) it could be that losing control is experienced more as a safety issue than colliding with vehicles. From that perspective the edge of the road where the curb and obstacles are, may be more present and a continuous threat that bicyclists (perhaps unconsciously) perceive. Therefore, bicyclists may experience a more central position on the road as having more space in both directions. Further research could focus on differences in infrastructure and interviewing bicyclists may give an idea if limited space is something they are aware of. Another future direction would be to study if these effects are also found in other countries with different infrastructures (see also Chataway, Kaplan, Nielsen, & Prato, 2014), different levels of participation of cycling, and other regulations. In Japan for example, bicyclists often cycle on the pavement and share that part of the road with pedestrians. As such, the effects found in this paper may be different in other countries.

Cyclist's head movement behaviour was also affected by mobile phone use, in that at intersections they make less head movements to the right. It has to be mentioned that the head movement behaviour measure taken in this study was a crude measure, just the number of head movements in two directions and may not actually reflect looking or seeing. One also has to be aware that looking in a direction does not necessarily mean perceiving what is happening. Nevertheless, to cross an intersection where the cyclist has no right-of-way moving your head in both directions, in order to get the best view, is likely to be required and we did find that the right-hand head movements of mobile phone using cyclists were less frequent than the head movements of non-phone users.

An important limitation of the present study is that behaviour could not be related to age, in particular because age was estimated. Even though the majority of included cyclists were between 15 and 60 years of age, estimated age of phone using cyclists does tend to be lower than of the non-telephone using cyclist. In ideal conditions the two groups would have a similar age distribution. We do not know whether there is an effect of age on lateral position choice, and could not determine that on the basis of the present data. Another limitation is that the number of observed calling cyclists is low, simply as a result of less people calling and more cyclists who operate the screen of their mobile telephone. This has had an effect on reliability of measurements in this condition, as is in particular visible in the large confidence interval displayed in Figure 4.

Compared with five years earlier the frequency of cyclists who use their mobile phone while cycling has not increased. This is in line with a study performed in another Dutch city, Terzano (2013) that also found that about 3-3.5 % of the bicyclists operated a mobile phone while cycling. A major difference with 2008 is, however, what people were doing with their phone. This has changed, in that as stated earlier, less people call and more type, text and perhaps use applications on their phones. This implies that their attention is focussed on a small screen, and not on the road. As this is a direct threat to safety, the policy advice given in 2010 (De Waard et al., 2010) that education when to use a phone and how is likely to be more effective than enforcement, should perhaps be reviewed. Education, in terms of making young cyclists aware of the dangers of operating a mobile phone while cycling, remains necessary (see also Mwakalonge et al., 2014, for an overview of public awareness programmes), but perhaps allowing handheld use of telephones while cycling in the Netherlands should be reconsidered. Accident data could support this idea and make the issue more urgent, but unfortunately these data are not completely reliable and lag behind the current situation. All in all this is reason to continue to monitor what is happening out on the road.

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Figures

Figure 1. Pictures from the six locations, from left to right, top to bottom: Road 1 (before the bicycle lane), bicycle lane, one way bicycle path, two way bicycle path, Road 2 (before the intersection), intersection.

Figure 2. Measurement of lateral position with a digital ruler: distance of the front wheel from the curb.

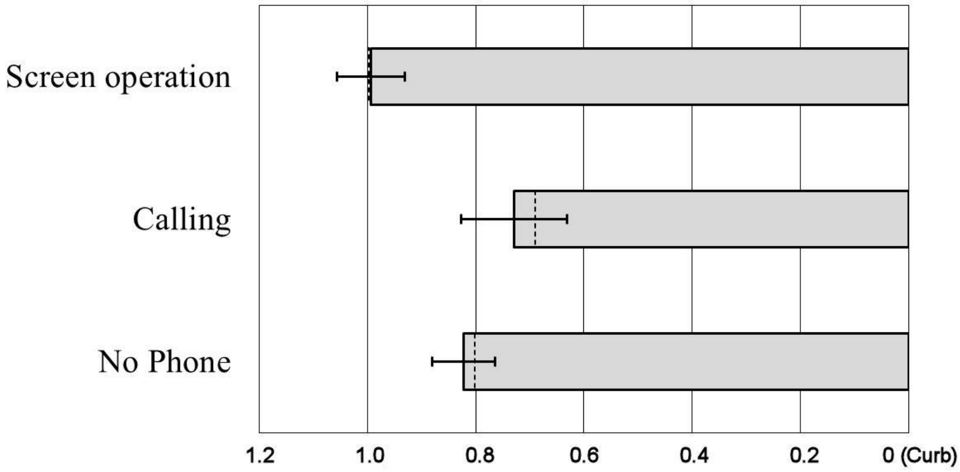

Figure 3. Average distance from the curb in metres by activity observed. Error bars reflect 95% confidence intervals, the dashed lines (in the bars) reflect the median.

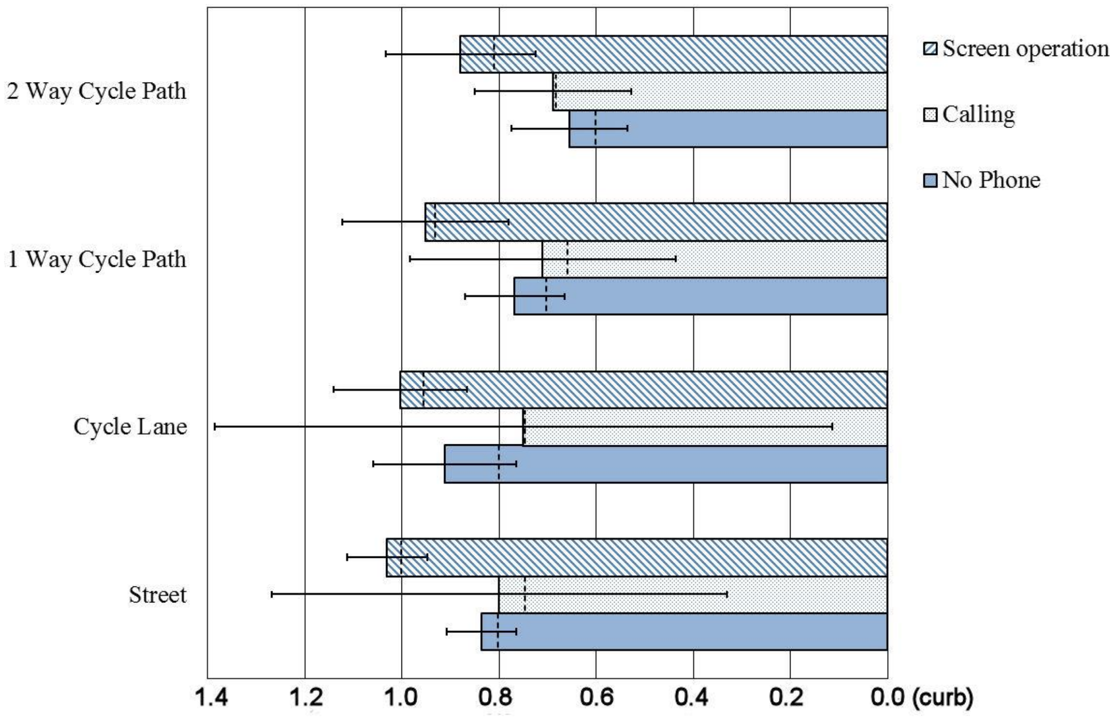

Figure 4. Average distance from the curb in metres per location (table 5) and activity observed. Error bars reflect 95% confidence intervals, the dashed lines in the bars reflect the median.

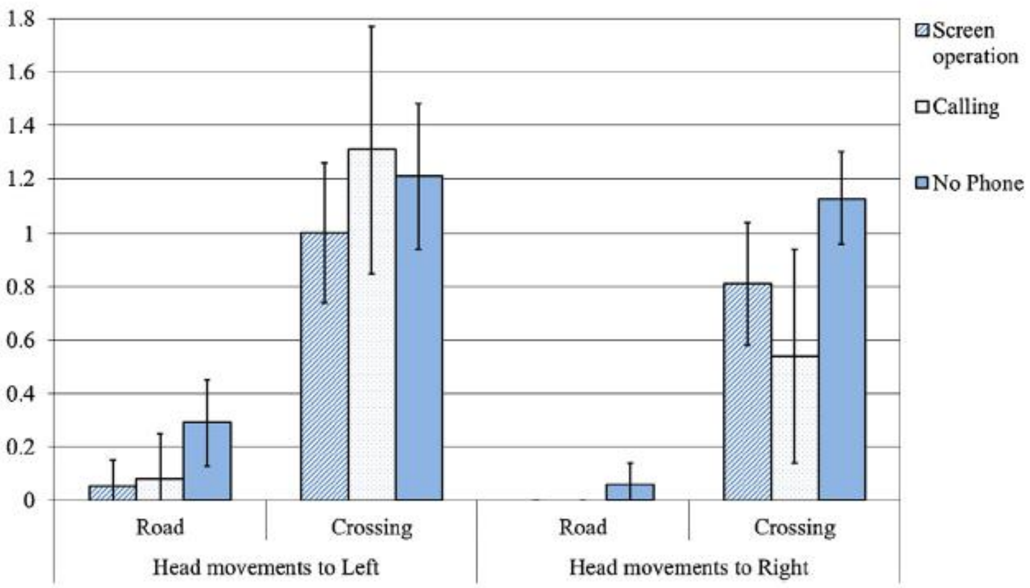

Figure 5. Average head movement frequencies on the road and crossing locations. Error bars reflect 95% confidence intervals.

Table 1. The three main comparisons (2 x 3 locations) made and measurements taken, see also Figure 1 for an illustration of the locations. A plus sign indicates that this measure was assessed in the comparison and a minus sign indicates that it was not measured. Number of hours, time of day and exact location where data were recorded at each location are shown at the right hand side.

Comparison	Variables assessed			Hours recorded	Recording times	Recording locations in Groningen
(Locations)	Lateral Position	Gender	Gaze/head movements			
[1] Road: Bicycle lane vs. sharing (no indication)	+	+	–	11	12:00-17:00	St Walburgsstraat – Kreupelstraat
[2] Separate bicycle path: One vs. two way traffic	+	+	–	15	11:00-14:00 & 16:00-19:00	Stationsweg
[3] Road vs. intersection	–	+	+	11	8:00-9:00 & 16:00-18:00	Kerklaan vs. crossing Kerklaan-Kruissingel

Table 2. The infrastructural characteristics of the locations where bicyclists' behaviour was compared, see Figure 1 for photos of the locations

Location	*Road or lane width*	*Characteristics*
Bicycle lane	1.3 m	Red coloured
Road 1 (preceding bicycle lane)	7.8 m	Grey asphalt
One way bicycle path	2.2 m	-
Two way bicycle path	3.0 m (per direction: 1.5 m)	Small centre line
Road 2 (preceding intersection)	6.0 m	-
before/after intersection	6.0 m	Give way to left and right

Table 3. The comparison of participant data from the current study to an earlier, 2008, study by De Waard et al. (2010). Calling reflects holding the telephone against an ear and talking, Screen operation includes texting and operating the phone, e.g. to search for an address or read a message.

Year:	2008(*)	2013
N (Total)	2138	7102
N (Phone use)	60	211
% Phone use	2.8	3.0
N (Calling)	47	49
N (Screen operation)	13	163
Calling-absolute %	2.2	0.7
Screen operation-absolute %	0.6	2.3
Of phone users:		
Calling %	79	23
Screen operation %	21	77

(*) De Waard et al. (2010)

Table 4. Number and percentage of sampled participant's data for the four locations where lateral position was scored.

Location	Not using a phone (N)	Screen operation (N)	Calling (N)	Total (N)	% male	% vehicle present
2 Way bicycle Path	15	9	6	30	47	-
1 Way bicycle Path	19	16	4	39	44	-
Bicycle lane	34	32	2	68	47	11.8
Street	42	39	4	85	40	4.7
Total	110	96	16	222		

Table 5. Results of the Mann-Whitney U Tests for group differences on lateral position.

Phone Use Groups	N	Mean Rank	Z	P-Value	Effect size (r)
1.No Phone vs.	110	86.63	-4.359	<.001	-0.30
2.Screen operation	96	122.83			
1.No Phone vs.	110	65.03	-1.235	NS	
3.Calling	16	53.00			
2.Screen operation vs.	96	61.04	-3.635	<.001	-0.34
3.Calling	16	29.25			

Table 6. The mean distance from the curb (in metres) with and without (corrected) motorised vehicle influence.

Phone Use Groups	Mean	Mean without vehicles present
No Phone	0.82	0.84
Screen operation	0.99	1.00
Calling	0.73	0.74

Table 7. Number of participants (N) selected from each location [3] in Table 3 by location.

Location	Not using a phone	Screen operation	Calling	Total
Intersection	41	27	14	82
Road	34	21	13	68
Total	75	48	27	150

Table 8. Results of the Mann-Whitney U Tests for effects on head movements by location (intersection vs. road).

Variable	Location	N	Mean Rank	Z	P-Value	Effect size (r)
Left head movement frequency	Road	68	46.35	-7.905	<.001	-0.65
	Intersection	78	97.17			
Right head movement frequency	Road	68	43.99	-8.969	<.001	-0.74
	Intersection	78	99.23			

Table 9. Kruskal-Wallis test results for the effects of phone usage (no phone, screen operation and calling conditions) on total head movements and left, forward and right head movement frequencies on the crossing location.

Variable	H (χ^2)	df	p-value	p (Monte Carlo)
Left head movement frequency	1.521	2	NS	NS
Right head movement frequency	11.264	2	0.004	0.003

Table 10. Mann-Whitney U Test results for Phone Use group differences (effect of using a telephone and what was done with the telephone) at the crossing location for right head movement frequency. All significant results are reported using a Bonferroni-correction for two multiple comparisons (α = 0.025).

Variable	Phone Use Groups	N	Mean Rank	Z	p-value	Effect size (r)
Right head movement frequency	1.No Phone vs.	39	36.53	-2.265	0.024	-0.28
	2.Screen operation	26	27.71			
	1.No Phone vs.	39	29.65	-3.037	0.002	-0.04
	3.Calling	13	17.07			